

*EFFECTS OF DEPRIVATION ON ENGAGEMENT IN  
PREFERRED ACTIVITIES BY PERSONS WITH  
DEVELOPMENTAL DISABILITIES*

KEVIN P. KLATT, JAMES A. SHERMAN, AND JAN B. SHELDON

UNIVERSITY OF KANSAS

This study examined the effects of deprivation on engagement in activities for 3 adult men with developmental disabilities. First, an assessment was conducted to identify a high- and a low-preference activity for each participant. Second, the high-preference activity was made available following three amounts of deprivation of the activity (15 min, 2 hr, and 1 to 4 days); the low-preference activity was made available following the schedule of deprivation that produced the highest level of engagement by each participant in the high-preference activity. The results were that 1 to 4 days of deprivation produced the highest average amounts of engagement in the high-preference activity for each participant; this amount of deprivation did not produce high engagement in the low-preference activities. Third, the deprivation procedures and results were replicated when high-preference activities were presented by teachers during the participants' daily activities when their engagement had been quite low.

DESCRIPTORS: establishing operations, deprivation, engagement, preferences, developmental disabilities

Identifying establishing operations (EOs) has been useful in selecting intervention strategies to reduce problem behavior. For example, Horner, Day, and Day (1997) identified potential EOs for the problem behavior of 3 adolescents with severe intellectual disabilities. For 1 individual, a delay in planned activities functioned as an EO, making escape from instructional tasks more reinforcing. A neutralizing routine was developed that allowed the individual an opportunity to engage in a preferred activity for 10 min on days when planned activities were delayed, resulting in reduced problem behaviors. Without identifying the EOs that

affected problem behaviors, intervention strategies may not have been as effective.

The empirical study of EOs has mainly focused on problem behaviors of persons with developmental disabilities (McGill, 1999; Smith & Iwata, 1997). Only a few studies have investigated EOs for other kinds of behavior. In an early example of the effects of EOs on human behavior, Gewirtz and Baer (1958) demonstrated the effects of deprivation of social praise on a marble-dropping task with children. In this study, rates of marble dropping were higher in conditions when social praise was not delivered prior to the task than in conditions when social praise was given prior to the task. Presumably, social praise was more reinforcing following a short period of deprivation.

Vollmer and Iwata (1991) investigated the relationship between EOs and the appropriate behavior of 5 adults with developmental disabilities. In this study, participants were allowed to engage in a motor task before and after they had an opportunity to "consume" consequences consisting of food, praise, or music. For all 5 participants, responding was

---

We thank the participants and teachers for their participation in the study. The first author thanks K. Renee Norman, Melissa Chindamo, and Angela Keene for assistance in collecting interobserver agreement data. We also thank Ed Morris, Don Baer, and Diane Bannerman Juracek for comments on an earlier draft.

Correspondence should be sent to the first author, who is now at the Behavior Analysis Program in the Community Psychology Department, Education Building, 720 Fourth Ave. S., St. Cloud State University, St. Cloud, Minnesota 56301-4498.

higher on the motor task after deprivation conditions than after satiation conditions.

A benefit of studying the effects of EOs for appropriate behavior is to identify variables, in addition to those detected using the traditional three-term contingency, that could lead to more effective interventions. For example, if an EO for engagement is identified, such as deprivation of activities, then deprivation could be manipulated to increase engagement for persons with developmental disabilities.

The purposes of the present study were, first, to investigate the effects of deprivation of preferred activities on engagement by persons with developmental disabilities and, second, to use this information to increase time spent engaged during transition times when engagement in activities was typically low.

### GENERAL METHOD

This study was conducted in three phases. In the first phase, an assessment was conducted to determine relative preference for activities in which each participant could engage at home. In the second phase, high-preference and low-preference activities were selected for each participant. Participants were then given opportunities to engage in the high-preference activity following three schedules of deprivation. Participants were also given an opportunity to engage in the low-preference activity following a period of deprivation that produced the highest engagement with the high-preference activity. The third phase consisted of a replication of the procedures of Phase 2 by teachers during times of the day when engagement was low (transitions). The results from Phase 3 were compared to engagement levels during times when the preferred activity was not available.

#### *Participants and Setting*

The participants in this study were 3 adult men with developmental disabilities.

D.J. was 49 years old with a diagnosis of severe mental retardation. He lived in an apartment with two male roommates, including the 2nd participant (Y.E.). Y.E. was 30 years old with a diagnosis of severe mental retardation. T.D. was 40 years old with a diagnosis of profound mental retardation. T.D. lived in an apartment with two roommates who also had developmental disabilities. All phases of the study took place in the participants' apartments.

#### *Dependent Variable*

The dependent variable in this study was *engagement*, defined in Phases 1, 2, and 3 as actively manipulating an item (activity) presented to the participant. For example, if a puzzle was presented as the activity, engagement was scored if the participant was either looking at or putting the pieces together.

To establish a comparison for Phase 3, engagement was observed on several occasions during 15-min blocks of transition periods, which were periods between scheduled activities. These were "free times" during which a participant could engage in any activities naturally found in his home (e.g., watch television, talk to a teacher, etc.). Because the preferred activity was not available during these observations, engagement was defined as performing any appropriate task, manipulating any object in an appropriate manner, participating in any appropriate activity, following instructions, or having a conversation in which he and another person were taking turns talking and listening. Examples included cleaning, conversing, and eating.

#### *Independent Variable*

The independent variable was deprivation of an activity. The high-preference activity was made available to a participant after 15 min, 2 hr, or 1 to 4 days of deprivation (time since the previous opportunity to engage in the activity). The low-preference ac-

tivity was made available only after 1 to 4 days of deprivation. Only one activity was presented during each session.

#### *Procedure*

All activity materials were kept with the experimenter between sessions. At the beginning of each session, the experimenter brought the materials to the home of the participant. The participant was asked if he wanted to participate in the activity. If the participant said yes, he was told that he could stop the activity at any time. All 3 of the participants had the ability to say that they wanted to stop an activity. If a participant said that he wanted to stop, he was immediately permitted to stop. During Phase 1 (preference assessment), an activity was available and engagement was recorded until a participant said he wanted to stop or 40 min passed, whichever occurred first. There was no time limit on engagement during Phases 2 and 3. To sample engagement during transition times, observations immediately prior to and during Phase 3 were conducted in 15-min blocks. In addition, data were recorded and analyzed only during the portion of the 15-min blocks when the participant was visible to the experimenter.

During all sessions, the experimenter and the teacher did not initiate conversation or praise a participant. They did, however, answer any of the participants' questions.

To assess the implementation of procedures, an observer periodically recorded the following information: Was the length of time since the last session accurately recorded on the experimenter's data sheet? Did the experimenter offer the activity to the participant and ask him if he would like to participate? Did the experimenter tell the participant that he could stop the activity at any time? After the participant said that he was done, did the experimenter ask him if he would like to continue or wanted to stop? The observer's records indicated that these

procedures were implemented with 100% fidelity during the integrity checks.

#### *Measurement System*

Engagement was measured using a 15-s partial-interval recording procedure. If a participant was engaged in the activity during any portion of the 15-s interval, engagement was recorded.

In Phases 1 and 2, data were calculated as the total number of 15-s intervals with engagement. During the observations prior to and in Phase 3, data were converted to percentages because the participant was not visible during all 15-s intervals. This was done by dividing the number of 15-s intervals with engagement by the total number of intervals observed during the 15-min block (60 intervals possible) and multiplying the result by 100%.

#### *Experimental Design*

An alternating treatments design (Barlow & Hayes, 1979) was used to evaluate the effects of deprivation on engagement. Conditions of deprivation were alternated semi-randomly each session by drawing a slip of paper from an envelope depicting one of the three different conditions of deprivation. Several circumstances, however, prevented the conditions from being presented truly randomly (e.g., the participant's schedule precluded him from being available).

#### *Interobserver Agreement*

Interobserver agreement on engagement was assessed by having a second observer collect data using the same measurement system described above. Agreements and disagreements were determined on an interval-by-interval basis; the number of agreements between the two observers was divided by the number of agreements and disagreements and the result was multiplied by 100%. For D.J., agreement on engagement was assessed for 20% of sessions and aver-

aged 99%. Agreement was assessed for 31% of sessions for Y.E., with an average of 99%. For T.D., agreement was assessed for 15% of sessions, and averaged 100%.

#### PHASE 1: PREFERENCE ASSESSMENT

##### Method

To identify activities that could be used in Phases 2 and 3, a preference assessment was conducted. First, teachers and family members who knew the participant well were asked what types of activities he liked. Next, various activity items were brought to the home of the participant. Each activity was presented once during the preference assessment, and only one session was conducted per day. Most of the activities were presented at a table where the participant and experimenter sat across from each other. The experimenter first modeled the activity (e.g., put an ink cartridge inside the squiggle pen, turned on the pen, and drew on a piece of paper). The experimenter then asked the participant if he wanted to do the activity. If the participant said yes, the experimenter gave him the item and began collecting data until either the participant asked to stop or 40 min passed. At least 10 different activities were presented to each participant during the assessment phase.

##### Results

The results of the preference assessment for each participant revealed a hierarchy of activities, as shown in Figure 1. Because the purpose of the preference assessment was to identify activities for which the participants displayed different amounts of engagement, several items were available to be used as high- and low-preference activities for each participant. The selection of the high- and low-preference activities used in the subsequent phases was based on engagement data from the preference assessment, the estimated amount of time a participant might engage in an activity and whether this maxi-

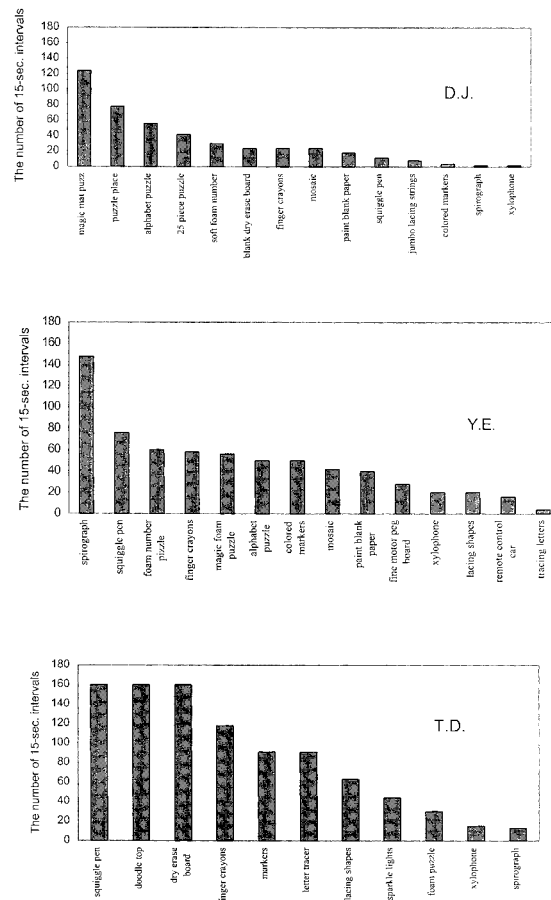


Figure 1. Preference assessment measured by engagement in various activities.

imum would interfere with normally scheduled activities of the participant, and potential availability and cost of replacing the item if it were broken during use.

Because D.J. engaged in a specific puzzle (magic mat) for 124 15-s intervals, this puzzle was selected as the high-preference activity for use in Phase 2. Later, as described below, a variety of puzzles were used as the high-preference activity. For Y.E., the activity resulting in the highest engagement (spirograph) was difficult to find in area stores and hence could not be easily replaced if broken. So the next activity in the hierarchy, a squiggle pen, was used as the high-preference activity in Phase 2. Results from T.D.'s

preference assessment revealed that the three activities engaged in most often had to be stopped due to the 40-min time limit. In addition, teachers who worked with T.D. reported that he often engaged in those activities for long periods of time and that if he were permitted to engage in those activities until he said that he wanted to stop, it might interfere with his normally scheduled activities. Therefore, finger crayons were selected as the high-preference activity for Phase 2. It should be noted that T.D. engaged in the use of the finger crayons during 118 intervals.

The low-preference activities were chosen based on engagement data from the preference assessment and ease of implementation. Consequently, the activities lowest in engagement were not chosen because it was difficult to utilize some of them multiple times for practical reasons. For example, the xylophone made a loud noise and disturbed roommates, and the remote control car was difficult to run when the apartment was crowded (these difficulties were not known prior to the assessment). The low-preference activities chosen included the squiggle pen for D.J. and lacing shapes for both Y.E. and T.D.

#### PHASE 2: CONDITIONS OF DEPRIVATION

##### *Method*

Access to activities was provided 15 min, 2 hr, or 1 to 4 days after the last time the participant engaged in the activity. Data from the 1-, 2-, 3-, and 4-day deprivation periods were combined because of minimal differences in levels of engagement. In all three conditions, the activities were presented at varying times of the day depending on the schedule of the experimenter and the participant. The activities identified as low preference were presented only after 1 to 4 days of deprivation because initial data with the high-preference activities suggested this

condition was most likely to produce the highest level of engagement.

##### *Results and Discussion*

Results of Phase 2 are shown in Figure 2. For D.J., levels of engagement with the high-preference activity (puzzle) averaged 3 intervals during the 15-min condition, 10 intervals during the 2-hr condition, and 23 intervals during the 1- to 4-day condition. Engagement in both the 2-hr and 1- to 4-day conditions declined over time, perhaps a result of doing the same puzzle repeatedly. To address this, D.J. was subsequently given a choice of various puzzles throughout each session. When various puzzles were available, D.J.'s engagement averaged 4, 26, and 34 intervals in 15-min, 2-hr, and 1- to 4-day conditions, respectively, and did not show a decreasing trend over time. Y.E.'s engagement with the squiggle pen averaged 2 intervals in the 15-min condition, 31 intervals in the 2-hr condition, and 33 intervals in the 1- to 4-day condition. T.D.'s engagement with the finger crayons averaged 0 intervals in the 15-min condition, 83 intervals in the 2-hr condition, and 108 intervals in the 1- to 4-day condition.

Figure 3 shows engagement in the low-preference activity after 1 to 4 days of deprivation during successive sessions compared to the average engagement in the high-preference activity after 1 to 4 days of deprivation. For D.J., engagement in the low-preference activity averaged six intervals, compared to an average of 34 intervals with the high-preference activity. Y.E.'s engagement in the low-preference activity averaged nine intervals, compared to an average of 33 intervals with the high-preference activity. T.D.'s engagement with the low-preference activity averaged 17 intervals, compared to an average of 108 intervals with the high-preference activity. These data indicate that the results of the preference assessment accurately predicted relative levels of engage-



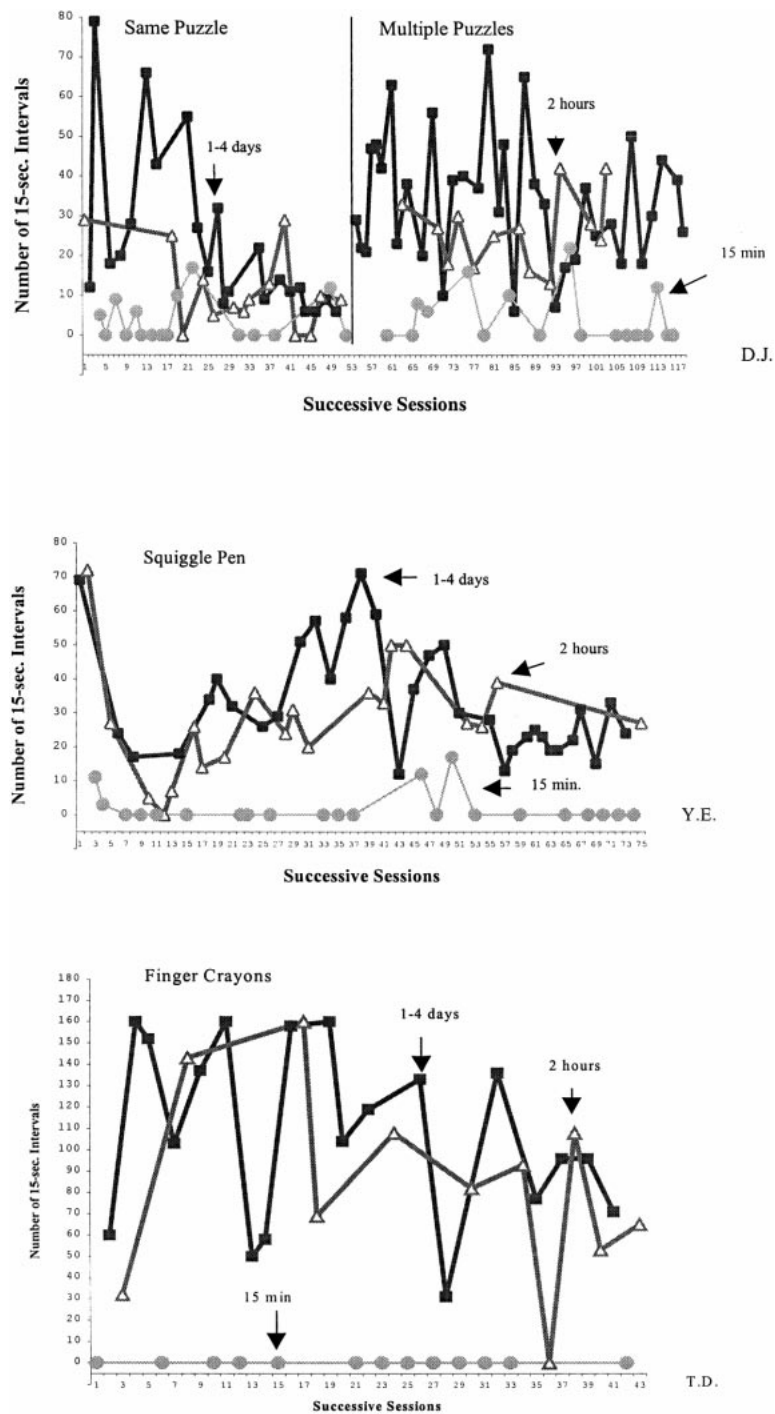


Figure 2. The number of intervals with engagement across three schedules of deprivation.

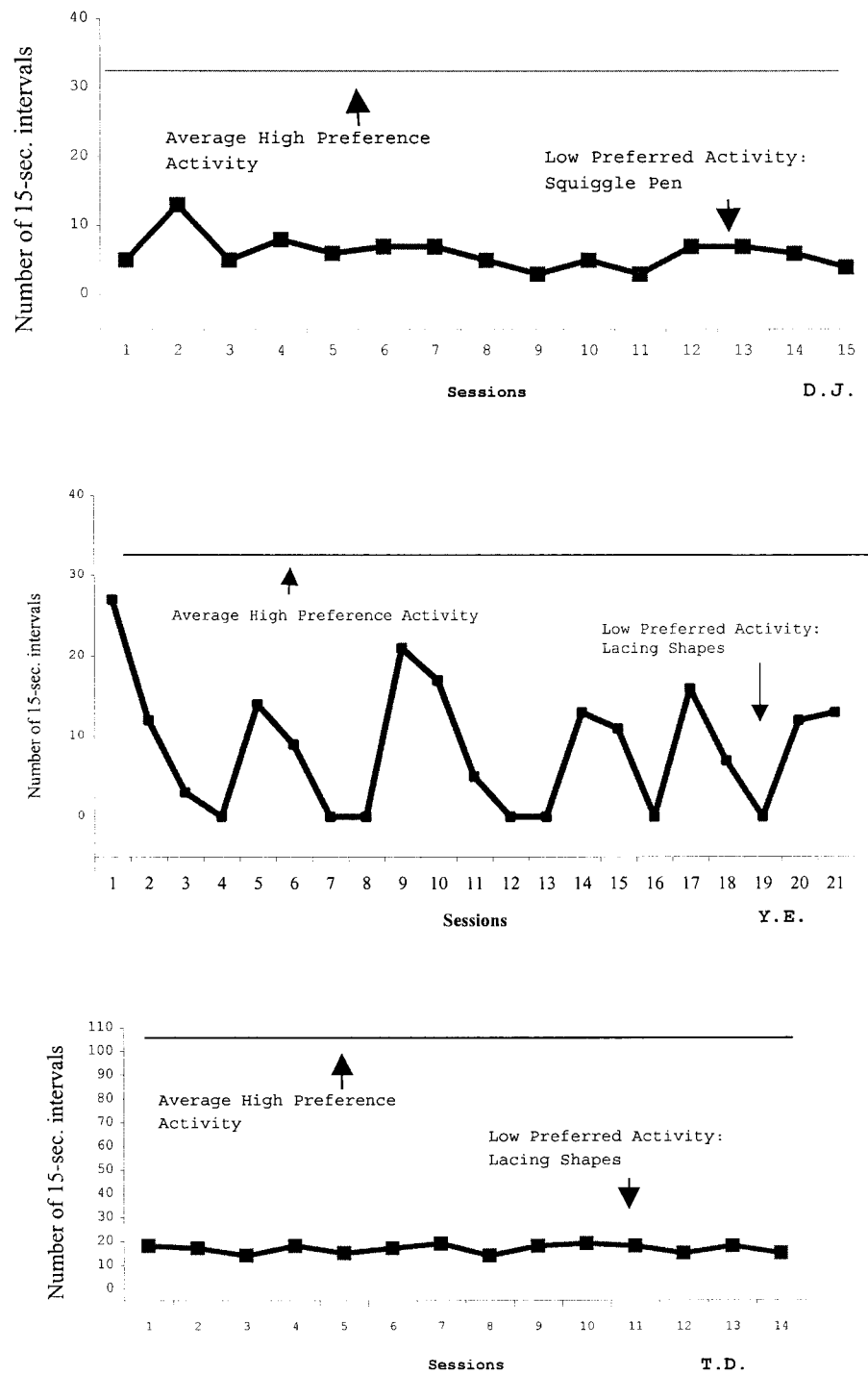


Figure 3. Engagement in the low-preference activity (1 to 4 days) compared to the average engagement in the high-preference activity (1 to 4 days).

ment during Phase 2. In addition, these data suggest that deprivation of access to the specific activities, not simply deprivation of, for example, access to any activity or the presence of the experimenter, controlled engagement.

### PHASE 3: INCREASING ENGAGEMENT DURING TRANSITION TIMES

#### *Method*

Prior to Phase 3, each participant's schedule was evaluated for periods when engagement was low. For D.J., the time selected was between dinner and bedtime. This transition was important because his parents had requested that he not go to bed before 8:00 p.m. Y.E.'s time was between lunch and going to work in the afternoon. Y.E.'s teachers reported that it was difficult to engage him at this time because he appeared anxious to go to work. The time identified for T.D. was midafternoon, when he had a change in his teaching staff. Teachers used this period to read and write shift reports.

During these observations, the experimenter arrived at the apartment and waited at least 15 min before beginning to collect data to allow the participant to acclimate to his presence. The experimenter then sat in a chair in the living room and recorded engagement (when the participant was in view) for a total of 15 min. Only intervals in which the experimenter could see the participant during the 15-min block were used in the data analysis.

Following the observations prior to Phase 3, a teacher presented high-preference activities during transition times according to the three schedules of deprivation. Although each participant was allowed to engage in the activity until he said that he wanted to stop, only engagement during the 15-min block is presented here.

#### *Results and Discussion*

The percentages of intervals scored with engagement during transition periods are

shown in Figure 4. During observations prior to Phase 3, D.J.'s engagement ranged from 5% to 38% of intervals, with an average of 18%. Corresponding levels of engagement for Y.E. ranged from 2% to 81% of intervals, with an average of 28%. T.D.'s engagement ranged from 0% to 21% of intervals, with an average of 4%.

When the high-preference activity was provided by teachers following a 15-min deprivation period, no engagement with the high-preference activity occurred for any of the participants. Engagement after 2 hr of deprivation for D.J., Y.E., and T.D. averaged 91%, 59%, and 80% of intervals, respectively. Engagement after 1 to 4 days of deprivation for D.J., Y.E., and T.D. averaged 76%, 76%, and 100% of intervals, respectively. The results of Phase 3 replicated those of Phase 2 and indicated that the deprivation procedure could be implemented by teachers in natural settings.

### GENERAL DISCUSSION

The purpose of this study was to investigate the effects of deprivation of a preferred activity on engagement by persons with developmental disabilities. The data from all 3 participants clearly indicated that a short duration of deprivation (15 min) resulted in little engagement. When participants were deprived of high-preference activities for 1 to 4 days, however, they engaged in the activities for a considerable period of time. Deprivation of high-preference activities for 2 hr resulted in engagement levels that were closer to the 1- to 4-day condition than to the 15-min condition. These results were replicated with a teacher during naturally occurring transition times. In contrast to the substantial effects observed with the high-preference activity, deprivation did not produce high levels of engagement in the low-preference activities, even when participants



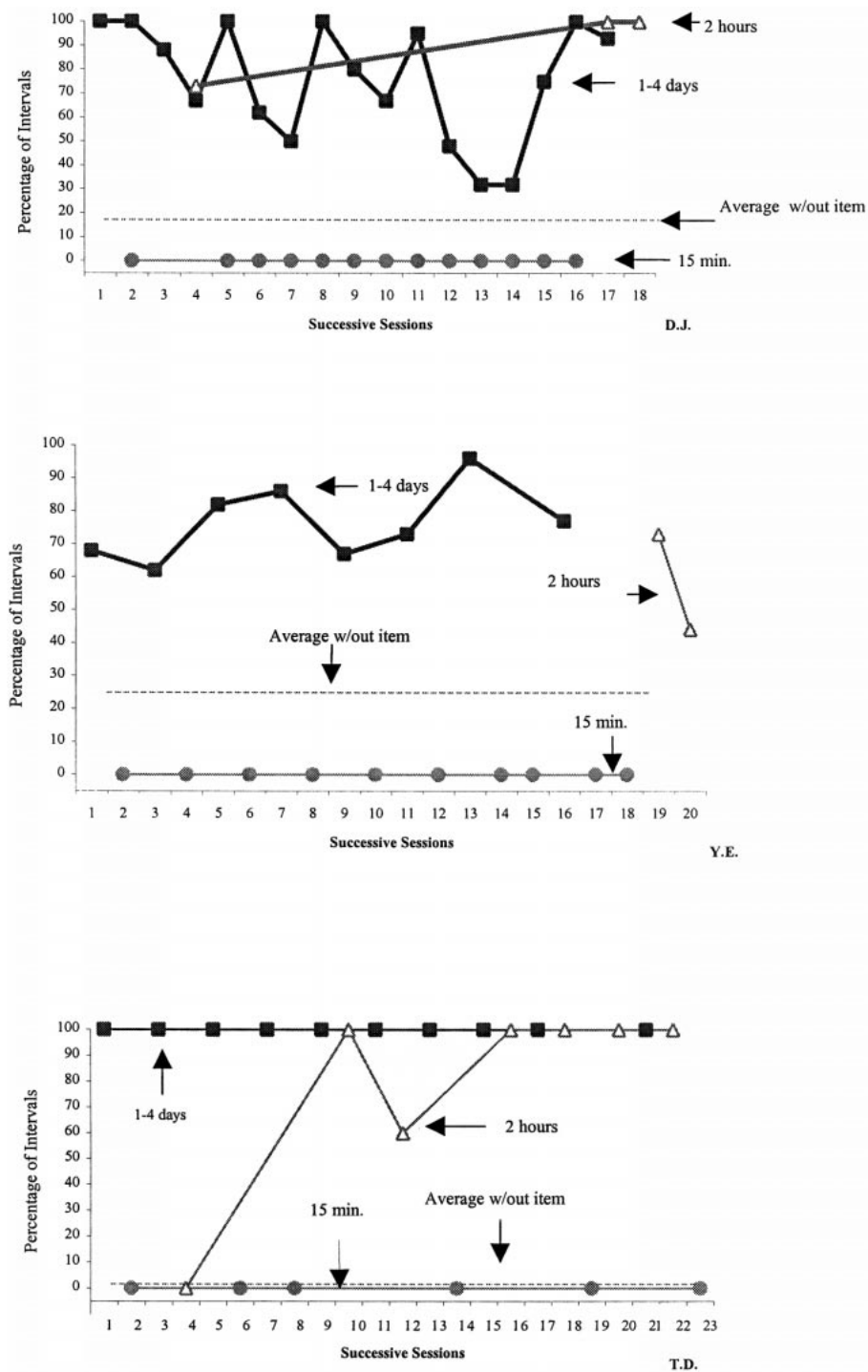


Figure 4. The percentage of intervals with engagement in 15-min blocks during transitions for the high-preference activity compared to the average engagement that occurred naturally.

had not had an opportunity to engage in these activities for 1 to 4 days.

Three major conclusions seem to be justified by the results of the present study. First, the original preference assessment was effective in providing reasonable estimates of participants' subsequent engagement in those activities. Second, the extent to which participants engaged in high-preference activities was a function of the length of time since their last opportunity to engage in the activity (deprivation). Third, differences in engagement in the high-versus low-preference activities indicate that deprivation of the experimenter's presence did not control responding (the experimenter was present for all activities, although the experimenter's presence itself was not actually experimentally manipulated). Thus, engagement was most likely affected by preference and deprivation of the activity.

The present results are consistent with previous findings by Vollmer and Iwata (1991), who found that deprivation altered the effectiveness of various reinforcers. The purpose of the present study, of course, was to study the effects of deprivation on the amount of engagement in activities, not the reinforcing effectiveness of those activities. Earlier studies (e.g., Pace, Ivancic, Edwards, Iwata, & Page, 1985), however, have shown that preference assessments similar to those conducted in the present study are predictive of the reinforcing effectiveness of opportunities to engage in those activities. These results and those of the present study suggest that the amount of free-operant engagement in activities is directly related to the effectiveness of those activities when opportunities to engage in them are used as consequences for behavior (for a discussion of response deprivation, see Allison & Timberlake, 1974, 1975; Eisenberger, Karpman, & Trattner, 1967; Timberlake & Allison, 1974).

Given that different lengths of deprivation

can affect engagement in high-preference activities, could this information be used to increase engagement during parts of the day when it was typically low? Although a short period of deprivation, such as 15 min, for high-preference activities resulted in little engagement, longer periods of deprivation increased engagement during transitions. Furthermore, deprivation periods of 2 hr or more resulted in an increase in engagement during transitions above the average level that occurred naturally. Because a frequent goal of programs serving people with developmental disabilities is to increase their engagement in appropriate activities (Favell & McGimsey, 1993), procedures utilizing response deprivation to increase engagement in various activities might be quite effective. It should be noted, however, that although these effects were obtained in Phase 3, long-term maintenance data were not collected.

Results from this study also have implications for conducting preference assessments. Because deprivation can affect the level of engagement in activities, special precautions should be taken to ensure that activities to be assessed are presented with similar amounts of deprivation. For example, measuring engagement in watching television immediately after viewing several hours of programming might underestimate an individual's preference for that activity. This potential problem could also be addressed by repeated measurement at different amounts of deprivation and averaging engagement levels (Gottschalk, Libby, & Graff, 2000).

Several potential shortcomings of this study should be addressed. For instance, in the present study the issue of deprivation of the activities was not systematically addressed prior to the preference assessment. None of the activities used in the preference assessment, however, were present in the living environments of the participants at the time the preference assessments were conducted. Therefore, it is likely that the par-

ticipants had not had an opportunity to engage in these activities for a considerable time, if ever, prior to the preference assessment. In addition, at least 1 day passed between the presentation of each activity.

Also, a 15-s partial-interval recording system was used to record engagement. Engagement was recorded during each interval when a participant manipulated the activity for any part of the 15 s. Although this could have resulted in an overestimation of engagement if the participants were engaged for only a few seconds of each interval, all the participants were typically engaged for most, if not all, of each interval when engagement was scored.

Finally, due to scheduling conflicts, conditions during the alternating treatments assessment were not always presented randomly. When the appropriate condition could not be presented, the next available condition was implemented. Thus, if it was not possible to implement a 15-min condition, then a 2-hr condition was implemented. In an alternating treatments design, conditions should be presented in random order to control for threats to internal validity (Campbell & Stanley, 1963). Despite this inherent weakness, threats to internal validity in this study were most likely controlled by the amount and duration of data collection in each condition. Although the data were variable in most of the conditions across participants, the average number of intervals engaged remained highest at 1 to 4 days and lowest at 15 min. In addition, the results were replicated across all 3 participants.

The study of EOs has already become important in discovering the variables that control problem behaviors for individuals with developmental disabilities. The study of EO effects for appropriate behavior, such as engagement, has not been as fully developed. The results from this study and others (e.g., Vollmer & Iwata, 1991) have shown that EOs can affect appropriate behaviors. Given

the importance of teaching and increasing appropriate behaviors, additional investigation of EO effects seems warranted.

## REFERENCES

- Allison, J., & Timberlake, W. (1974). Instrumental and contingent saccharin licking in rats: Response deprivation and reinforcement. *Learning and Motivation*, 5, 231–247.
- Allison, J., & Timberlake, W. (1975). Response deprivation and instrumental performance in the controlled-amount paradigm. *Learning and Motivation*, 6, 122–142.
- Barlow, D. H., & Hayes, S. C. (1979). Alternating treatments design: One strategy for comparing the effects of two treatments in a single subject. *Journal of Applied Behavior Analysis*, 12, 199–210.
- Campbell, D. T., & Stanley, J. C. (1963). *Experimental and quasi-experimental designs for research*. Chicago: Rand McNally.
- Eisenberger, R., Karpman, M., & Tractner, J. (1967). What is the necessary and sufficient condition for reinforcement in the contingency situation? *Journal of Experimental Psychology*, 74, 342–350.
- Favell, J. E., & McGimsey, J. F. (1993). Defining an acceptable treatment environment. In R. Van Houten & S. Axelrod (Eds.), *Behavior analysis and treatment* (pp. 25–45). New York: Plenum Press.
- Gewirtz, J. L., & Baer, D. M. (1958). The effect of brief social deprivation on behaviors for a social reinforcer. *Journal of Abnormal Social Psychology*, 56, 49–56.
- Gottschalk, J. M., Libby, M. E., & Graff, R. B. (2000). The effects of establishing operations on preference assessment outcomes. *Journal of Applied Behavior Analysis*, 33, 85–88.
- Horner, R. H., Day, H. M., & Day, J. R. (1997). Using neutralizing routines to reduce problem behaviors. *Journal of Applied Behavior Analysis*, 30, 601–614.
- McGill, P. (1999). Establishing operations: Implications for the assessment, treatment, and prevention of problem behavior. *Journal of Applied Behavior Analysis*, 32, 393–418.
- Pace, G. M., Ivancic, M. T., Edwards, G. L., Iwata, B. A., & Page, T. J. (1985). Assessment of stimulus preference and reinforcer value with profoundly retarded individuals. *Journal of Applied Behavior Analysis*, 18, 249–255.
- Smith, R. G., & Iwata, B. A. (1997). Antecedent influences on behavior disorders. *Journal of Applied Behavior Analysis*, 30, 343–375.
- Timberlake, W., & Allison, J. (1974). Response deprivation: An empirical approach to instrumental performance. *Psychological Review*, 81, 146–164.

- Vollmer, T. R., & Iwata, B. A. (1991). Establishing operations and reinforcement effects. *Journal of Applied Behavior Analysis*, 24, 279–291.
- Received February 28, 2000  
Final acceptance August 22, 2000  
Action Editor, Richard G. Smith*

### STUDY QUESTIONS

1. The authors state that the identification of establishing operations (EOs) may be useful in developing effective behavioral interventions. What general types of interventions might be most and least likely to be influenced by EOs?
2. How was engagement defined and measured during the three phases of the study?
3. What procedures were used to assess participants' activity preferences, and how were the results of these assessments used to select high- and low-preference activities?
4. What variable was manipulated in Phase 2, and what were the results of this manipulation?
5. How did the results obtained during Phase 3 compare with those obtained during Phase 2?
6. What are the two effects of an EO, and to what extent were those effects reflected in the data on stimulus engagement?
7. How might one conduct a study to determine whether deprivation from a given activity functions as an EO?
8. What implications do the results of this study have for altering levels of stimulus engagement without altering reinforcement contingencies?

Questions prepared by John Adelinis and April Worsdell, The University of Florida